(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
26 February 2004 (26.02.2004)

PCT

(10) International Publication Number
WO 2004/017238 A1

(51) International Patent Classification[7]: G06F 17/60, 17/30

(21) International Application Number: PCT/GB2003/003475

(22) International Filing Date: 11 August 2003 (11.08.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0218990.0 14 August 2002 (14.08.2002) GB

(71) Applicant *(for all designated States except US)*: MESSAGELABS LIMITED [GB/GB]; 1270 Landsdowne Court, Gloucestershire Business Park, Gloucester GL3 4AB (GB).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: SHIPP, Alexander [GB/GB]; Star Internet, Brighouse Court, Barn Wood, Gloucester GL4 3RT (GB).

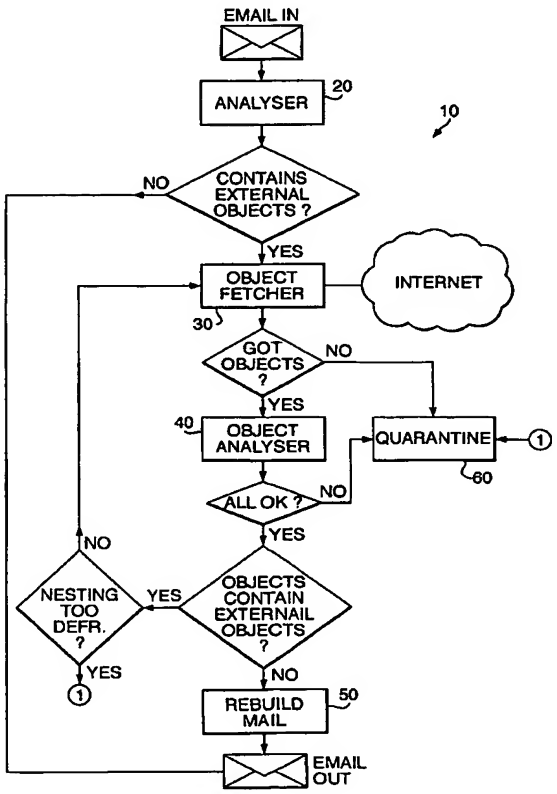
(74) Agents: AYERS, Martyn, Lewis, Stanley et al.; J.A. Kemp & Co., 14 South Square, Gray's Inn, London WC1R 5JJ (GB).

(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),

[Continued on next page]

(54) Title: METHOD OF, AND SYSTEM FOR, SCANNING ELECTRONIC DOCUMENTS WHICH CONTAIN LINKS TO EXTERNAL OBJECTS



(57) Abstract: A content scanner for electronic documents such as email scans objects which are the target of hyperlinks within the document. If they are determined to be acceptable, a copy of the object is attached to the document and the link is replaced by one pointing to the copied object.

WO 2004/017238 A1

European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Published:

— *with international search report*

METHOD OF, AND SYSTEM FOR, SCANNING ELECTRONIC DOCUMENTS WHICH CONTAIN LINKS TO EXTERNAL OBJECTS

Introduction

The present invention relates to a method of, and system for, replacing external links in electronic documents such as email with internal links. One use of this is to ensure that email that attempts to bypass email content scanners no longer succeeds. Another use is to reduce the effectiveness of web bugs.

Background

Content scanning can be carried out at a number of places in the passage of electronic documents from one system to another. Taking email as an example, it may be carried out by software operated by the user, e.g. incorporated in or an adjunct to, his email client, and it may be carried out on a mail server to which the user connects, over a LAN or WAN, in order to retrieve email. Also, Internet Service Providers (ISPs) can carry out content scanning as a value-added service on behalf of customers who, for example, then retrieve their content-scanned email via a POP3 account or similar.

One trick which can be used to bypass email content scanners is to create an email which just contains a link (such as an HTML hyperlink) to the undesirable or "nasty" content. Such content may include viruses and other varieties of malware as well potentially offensive material such as pornographic images and text, spam and other material to which the email recipient may not wish to be subjected. The content scanner sees only the link, which is not suspicious, and the email is let through. However, when viewed in the email client, the object referred to may either be bought in automatically by the email client, or when the reader clicks on the link. Thus, the nasty object ends up on the user's desktop, without ever passing through the email content scanner.

It is possible for the content scanner to download the object by following the link itself. It can then scan the object. However, this method is not foolproof – for instance, the server delivering the object to the content scanner may be able to detect that the request is from a content scanner and not from the end user. It may then serve up a different, innocent object to be scanned. However, when the end-user requests the object, they get the nasty one.

Summary of the Invention

The present invention seeks to reduce or eliminate the problems of embedded links in electronic documents and does so by having the content scanner attempt to follow a link found in an electronic document and scan the object which is the target of the link. If the object is found to be acceptable from the point of view of content-scanning criteria, it is retrieved by the scanner and embedded in the electronic document and the link in the electronic document is adjusted to point at the embedded object rather than the original; this can then be delivered to the recipient without the possibility that the version received by the recipient differs from the one originally scanned.

If the object is not found to be acceptable, one or more remedial actions may be taken: for example, the link may be replaced by a non-functional link and/or a notice that the original link has been removed and why; another possibility is that the electronic document can be quarantined and an email or alert generated and sent to the intended recipient advising him that this has been done and perhaps including a link via which he can retrieve it nevertheless or delete it. The process of following links, scanning the linked object and replacing it or not with an embedded copy and an adjusted link may be applied recursively. An upper limit may be placed on the number of recursion levels, to stop the system getting stuck in an infinite loop (e.g. because there are circular links) and to effectively limit the amount of time the processing will take.

Thus according to the present invention there is provided a content scanning system for electronic documents such as emails comprising:

a) a link analyser for identifying hyperlinks in document content;

b) means for causing a content scanner to scan objects referenced by links identified by the link analyser and to determine their acceptability according to predefined rules, the means being operative, when the link is to an object external to the document and is determined by the content analyser to be acceptable, to retrieve the external object and modify the document by

b1. embedding in it or attaching to it the retrieved copy of the object; and

b2. replacing the link to the external object by one to the copy embedded in, or attached to, the document.

The invention also provides a method of content-scanning electronic documents such as emails comprising:

a) using a link analyser for identifying hyperlinks in document content;

b) using a content scanner to scan objects referenced by links identified by the link analyser and to determine their acceptability according to predefined rules, the means being operative, when the link is to an object external to the document and is determined by the content analyser to be acceptable, to retrieve the external object and modify the document by

b1. embedding in it or attaching to it the retrieved copy of the object; and

b2. replacing the link to the external object by one to the copy embedded in, or attached to, the document.

Thus the content scanner can follow the link, and download and scan the object. If the object is judged satisfactory, the object can then be embedded in the email, and the link to the external object replaced by a link to the object now embedded in the email.

One trick used by spammers is to embody 'web bugs' in their spam emails. These are unique or semi-unique links to web sites – so a spammer sending out 1000 emails would use 1000 different links. When the email is read, a connection is made to the web site, and by finding which link has been hit, the spammer can match it with their records to tell which person has read the spam email. This then confirms that the email address is a genuine one. The spammer can continue to send email to that address, or perhaps even sell the address on to other spammers.

By following every external link in every email that passes through the content scanner, all the web bugs the spammer sends out will be activated. Their effectiveness therefore becomes much reduced, because they can no longer be used to tell which email addresses were valid or not.

The invention will be further described by way of non-limiting example with reference to the accompanying drawings, in which:-

Figure1 shows the "before" and "after" states of an email processed by an embodiment of the present invention; and

Figure 2 shows a system embodying the present invention.

Figure 1a shows an email 1 which comprises a header region 2 and a body 3 formatted according to an internet (e.g. SMTP/MIME) format. The body 3 includes a hypertext link 4 which points to an object 5 on a web server 6 somewhere on the internet. The object 5 may for example be a graphical image embedded in a web page (e.g. HTML or XHTML);

Figure1b shows the email 1 after processing by the illustrated embodiment of the invention and it will be seen that the object 5 has been appended to the email (e.g. as a MIME attachment) as item 5' and the link 4 has been adjusted so that it now points to this version of the object rather than the one held on the external server 6; and

Figure 2 is an illustration of a system 10, according to the present invention which may be implemented as a software automaton. Although the invention is not limited to this application, this example embodiment is given in terms of a content scanner operated by an ISP to process an email stream e.g. passing through an email gateway.

Operation of Embodiment

1) The email is analysed by analyser 20 to determine whether it contains external links. If none are found, omit steps 2 to 5.

2) For each external link, the external object is obtained by object fetcher 30 from the internet. If the object cannot be obtained, go to step 7.

3) The external objects are scanned by analyser 40 for pornography, viruses, spam and other undesirables. If any are found, go to step 7.

4) The external objects are analysed to see whether they contain external links. If the nesting limit has been reached, go to step 7. Otherwise go to step 2 for each external link.

5) The email is now rebuilt by email rebuilder 50. In the case of MIME email, the external links are replaced with internal links, and the objects obtained are added to the email as MIME sections. Non-MIME email is first converted to MIME email, and the process then continues as before.

6) The email is sent on, and processing stops in respect of that email.

7) An undesirable object has been found, or the object could not be retrieved, or the nesting limit has been reached. We may wish to block the email (processing stops), or to remove the links. We may also want to send warning messages to sender and recipient if the email has been blocked. Meanwhile the email may be held in quarantine as indicated at 60, which may be implemented as a reserved file directory.

Example

The following email contains a link to a website.

```
Subject: email with link
Subject:
Date: Thu, 9 May 2002 16:17:01 +0600
MIME-Version: 1.0
Content-Type: text/html;
Content-Transfer-Encoding: 7bit

<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.0 Transitional//EN">
<HTML><HEAD>
</HEAD>
<BODY bgColor=3D#ffffff>
<DIV> </DIV>
This is some text<BR>
<DIV><IMAGE src="http://www.messagelabs.com/images/global/nav/box-images/virus-eye-
light.gif" >
</DIV>
This is some more text<BR>
</BODY></HTML>
```

The binary content of "http://www.messagelabls.com/images/global/nav/box-images/virus-eye-light.gif" is as follows:

```
00000000  47 49 46 38 39 61 17 00 17 00 C4 00 00 80 80 80    GIF89a....Ä..€€€
00000010  64 56 04 00 00 00 52 52 53 C8 AB 04 FD FD FD FF    dV....RRSÈ«.ýýýÿ
00000020  D8 00 AA 90 04 FF CE 00 0B 21 57 34 2B 03 C6 C6    Ø.ª□.ÿÎ..!W4+.ÆÆ
00000030  C7 B0 AE AB 89 76 05 16 15 17 18 14 02 26 27 2C    Ç°®«‰v.......&',
00000040  C6 B1 4C BD BE C3 EF CB 03 24 1D 02 03 0B 1E 00    Æ±L½¾ÃïË.$......
00000050  2A 84 47 3C 03 0C 0A 05 93 8D 72 A1 9F 97 E2 E1    *„G<....“□r¡Ÿ—âá
00000060  E1 DB E1 F6 D8 BA 03 FF ED 01 E4 BE 1E 21 F9 04    áÛáöØº.ÿí.ä¾.!ù.
00000070  00 00 00 00 00 2C 00 00 00 00 17 00 17 00 00 05    .....,..........
00000080  F6 20 20 8E 64 69 8E 48 AA AE EA 64 20 EF 8B 88    ö  ŽdiŽHª®êd ï‹ˆ
00000090  EC FA 12 4D 73 74 04 FF D2 35 C3 A4 73 08 3C 14    ìú.Mst.ÿÒ5Ã¤s.<.
000000A0  8A 62 AE 07 5C 0D 3B 48 8C 40 F0 B8 20 1B 81 43    Šb®.\.;HŒ@ð¸ .□C
000000B0  33 65 20 5C 1A D3 B0 98 72 09 88 0C E8 57 E7 22    3e \.Ó°˜r.ˆ.èWç"
000000C0  6E 87 A5 A2 03 D6 FA 70 DB A7 22 E9 5D E0 D0 B7    n‡¥¢.ÖúpÛ§"é]àÐ·
000000D0  1F 71 0F 01 14 6F 03 19 0B 1A 0E 53 7A 49 1D 22    .q...o.....SzI."
000000E0  01 01 60 7C 00 12 05 05 12 03 03 02 09 03 00 18    ..`|............
000000F0  14 01 04 8F 1D 75 10 0B 96 96 03 10 9A 16 09 1B    ...□.u..––..š...
00000100  9A 02 17 22 13 60 18 A7 A8 05 B0 15 AD 0C 10 53    š.."‘`.§¨.°.-..S
00000110  80 00 13 84 03 B8 96 0C 0E 09 16 16 15 0E 82 65    €..„.¸–.......‚e
00000120  71 53 19 C5 96 0B 03 15 BF 07 1E 43 22 6C 02 0C    qS.Å–...¿..C"l..
00000130  B8 1B 12 19 AA 02 18 01 1D 32 06 22 C3 0B 00 99    ....ª....2."Ã..™
00000140  10 7D 9F 65 04 68 2B 71 C4 19 90 90 3A 04 2E F5    .}Ÿe.h+qÄ.□□:..õ
00000150  2C 67 22 70 88 90 A6 60 0D 7B 00 10 7C D8 10 E1    ,g"pˆ□¦`.{..|Ø.á
00000160  A0 C3 14 34 3E 14 D0 80 EE 61 8D 88 97 02 C8 B0     Ã.4>.Ð€îa□ˆ—.È°
00000170  A8 E2 84 C7 8F 21 00 00 3B                        ¨â„Ç□!..;
```

This file can be downloaded, scanned, and if acceptable, a new email can be created with the image embedded in the email:

```
Subject: email with link
Subject:
Date: Thu, 9 May 2002 16:17:01 +0600
MIME-Version: 1.0
Content-Type: multipart/related;
              boundary="ABCD";
Content-Transfer-Encoding: 7bit

--ABCD
```

```
Content-Type: text/html;
Content-Transfer-Encoding: 7bit

<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.0 Transitional//EN">
<HTML><HEAD>
</HEAD>
<BODY bgColor=3D#ffffff>
<DIV> </DIV>
This is some text<BR>
<DIV><IMAGE src=cid:EXTERNAL>
</DIV>
This is some more text<BR>
</BODY></HTML>

--ABCD
Content-ID: <EXTERNAL>
Content-Type: image/gif;
      name="image001.gif"
Content-Transfer-Encoding: base64
Content-Disposition: attachment;
      filename="image001.gif"

R0lGODlhFwAXAMQAAICAgGRWBAAAAFJSU8irBP39/f/YAKqQBP/OAAshVzQrA8bGx7Cuq4l2BRYV
FxgUAiYnLMaxTL2+w+/LAyQdAgMLHgAqhEc8AwwKBZONcqGfl+Lh4dvh9ti6A//tAeS+HiH5BAAA
AAAALAAAAAAXABcAAAX2ICCOZGmOSKqu6mQg74uI7PoSTXN0BP/SNcOkcwg8FIpirgdcDTtIjEDw
uCAbgUMzZSBcGtOwmHIJiAzoV+ciboelogPW+nDbpyLpXeDQtx9xDwEUbwMZCxoOU3pJHSIBAWB8
ABIFBRIDAwIJAwAYFAEEjx11EAuWlgMQmhYJG5oCFyITYBinqAWwFa0MEFOAABOEA7iWDA4JFhYV
DoJlcVMZxZYLAxW/Bx5DImwCDLgbEhmqAhgBHTIGIsMLAJkQfZ91BGgrccQZkJA6BC71LGcicIiQ
pmANewAQfNgQ4aDDFDQ+FNCA7mGNiJcCyLCo4oTHjyEAADs=

--ABCD--
```

CLAIMS

1. A content scanning system for electronic documents such as emails comprising:

a) a link analyser for identifying hyperlinks in document content;

b) means for causing a content scanner to scan objects referenced by links identified by the link analyser and to determine their acceptability according to predefined rules, the means being operative, when the link is to an object external to the document and is determined by the content analyser to be acceptable, to retrieve the external object and modify the document by

b1. embedding in it or attaching to it the retrieved copy of the object; and

b2. replacing the link to the external object by one to the copy embedded in, or attached to, the document.

2. A system according to claim 1 wherein the link analyser a) and means b) are operative to recursively process links identified in such external objects.

3. A system according to claim 2 in which only a maximum depth of recursion is permitted and the document is flagged as unacceptable if that limit is reached.

4. A system according to claim 1, 2 or 3 wherein acceptable retrieved objects are encoded into MIME format.

5. A system according to any one of the preceding claims wherein if any linked-to object is determined by the content scanner to be unacceptable the document is flagged or modified to indicate that fact.

6. A method of content-scanning electronic documents such as emails comprising:

a) using a link analyser for identifying hyperlinks in document content;

b) using a content scanner to scan objects referenced by links identified by the link analyser and to determine their acceptability according to predefined rules, the means being operative, when the link is to an object external to the document and is determined by the content analyser to be acceptable, to retrieve the external object and modify the document by

b1. embedding in it or attaching to it the retrieved copy of the object; and

b2. replacing the link to the external object by one to the copy embedded in, or attached to, the document.

7. A method according to claim 6 wherein the steps a) and b) are used recursively to process links identified in such external objects.

8. A method according to claim 7 in which only a maximum depth of recursion is permitted and the document is flagged as unacceptable if that limit is reached.

9. A system according to claim 6, 7 or 8 wherein acceptable retrieved objects are encoded into MIME format.

10. A method according to any one of claim 6 to 9, wherein if any linked-to object is determined by the content scanner to be unacceptable the document is flagged or modified to indicate that fact.

11. A content scanning system for electronic documents substantially as hereinbefore described and with reference to the accompanying drawings.

12. A method of content-scanning electronic documents substantially as hereinbefore described and with reference to the accompanying drawings.

Fig.1a.

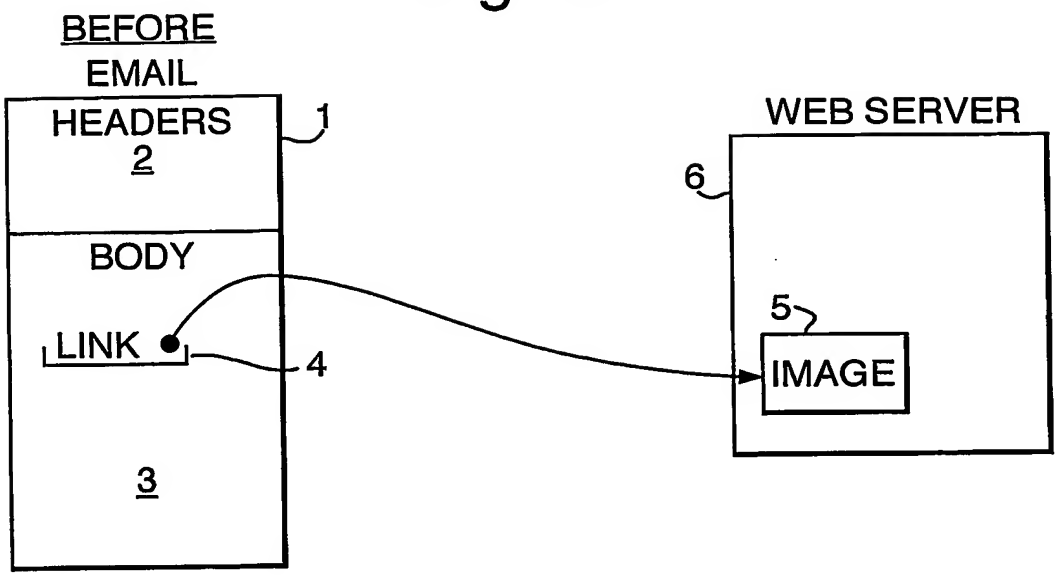

BEFORE
EMAIL
HEADERS
2
1
BODY
LINK
4
3
WEB SERVER
6
5
IMAGE

Fig.1b.

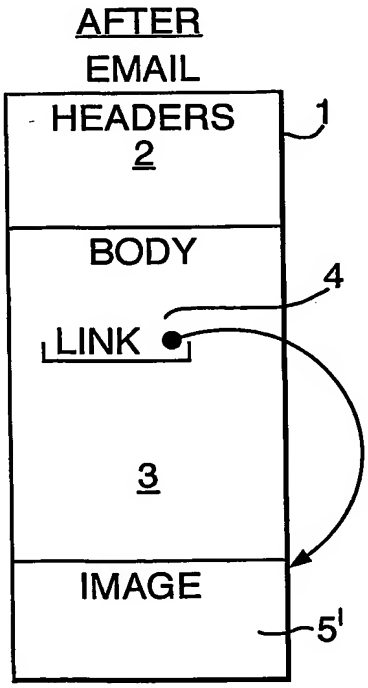
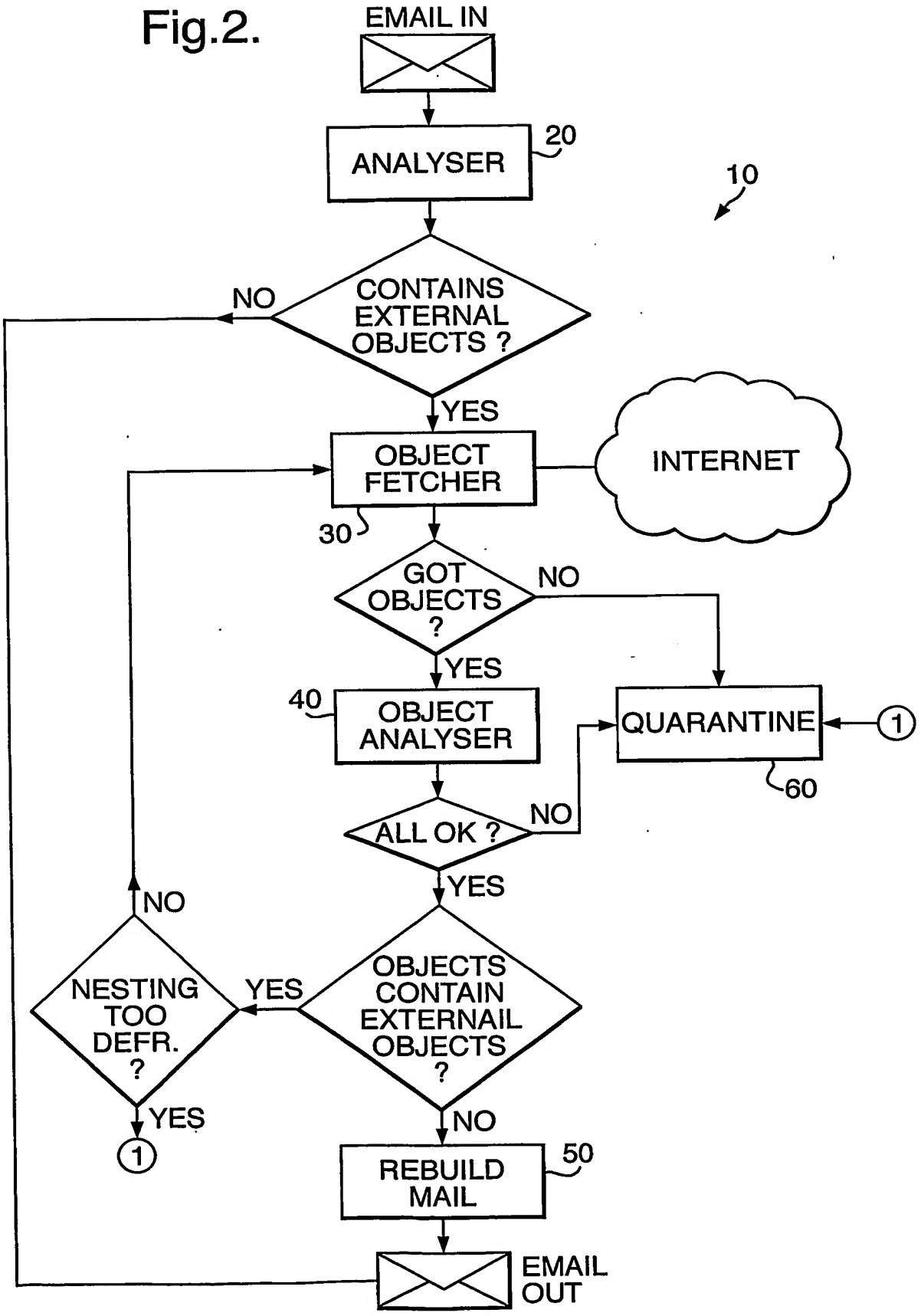

AFTER
EMAIL
HEADERS
2
1
BODY
4
LINK
3
IMAGE
5'

Fig.2.


EMAIL IN
ANALYSER
20
10
CONTAINS EXTERNAL OBJECTS ?
NO
YES
OBJECT FETCHER
INTERNET
30
GOT OBJECTS ?
NO
YES
40
OBJECT ANALYSER
QUARANTINE
1
60
ALL OK ?
NO
YES
NO
NESTING TOO DEFR. ?
YES
OBJECTS CONTAIN EXTERNAIL OBJECTS ?
YES
1
NO
REBUILD MAIL
50
EMAIL OUT

INTERNATIONAL SEARCH REPORT

Internatic pplication No
PCT/GB 03/03475

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G06F17/60 G06F17/30

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 00 65483 A (SURFNOTES INC ;HIRSCH SCOTT (US)) 2 November 2000 (2000-11-02) Sections 3, 3.2 and 5. page 3, line 4 - line 29; figure 13 ---	1-12
A	US 6 298 444 B1 (FOSS ANDREW L ET AL) 2 October 2001 (2001-10-02) column 2, line 42 -column 3, line 6 ---	1-12
A	"LOOK AHEAD FILTERING OF INTERNET CONTENT" IBM TECHNICAL DISCLOSURE BULLETIN, IBM CORP. NEW YORK, US, vol. 40, no. 12, 1 December 1997 (1997-12-01), page 143 XP000754118 ISSN: 0018-8689 the whole document ---	1-12

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the International search	Date of mailing of the International search report
17 October 2003	24/10/2003

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Huber, A

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Internatic pplication No
PCT/GB 03/03475

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	MONTEBELLO M ET AL: "Evolvable intelligent user interface for WWW knowledge-based systems" DATABASE ENGINEERING AND APPLICATIONS SYMPOSIUM, 1998. PROCEEDINGS. IDEAS'98. INTERNATIONAL CARDIFF, UK 8-10 JULY 1998, LOS ALAMITOS, CA, USA,IEEE COMPUT. SOC, US, 8 July 1998 (1998-07-08), pages 224-233, XP010294640 ISBN: 0-8186-8307-4 Sections 2.1, 2.2 and 2.5.1.	1-12

INTERNATIONAL SEARCH REPORT

Information on patent family members

Internat Application No
PCT/GB 03/03475

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0065483 A	02-11-2000	AU 4493000 A	10-11-2000
		WO 0065483 A2	02-11-2000
US 6298444 B1	02-10-2001	US 6119231 A	12-09-2000